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Claims

1. Receiving apparatus (1) for receiving signals in a digital telecommunication system,  
 with  
 10 receiving means (2, 3) for receiving a reference symbol comprising at least two  
 repetition patterns, whereby one of said at least two repetition patterns is phase shifted  
 in relation to the other repetition pattern, and  
 synchronising means (5) for synchronising the receiving apparatus (1) in the digital  
 telecommunication system using said received reference symbol,  
 15 whereby said synchronising means (5) comprises a cross correlation means (16; 24) for  
 cross correlating at least one of said two repetition patterns within a cross correlation  
 window having a predetermined length.
2. Receiving apparatus for receiving signals in a digital telecommunication system  
 20 according to claim 1,  
**characterized in,**  
 that said at least two repetition patterns are the last two repetition patterns in said  
 reference symbol.
- 25 3. Receiving apparatus for receiving signals in a digital telecommunication system  
 according to claim 1 or 2,

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characterized in,

that said phase shifted repetition pattern is phase shifted by  $180^\circ$  in relation to said other repetition pattern.

- 5 4. Receiving apparatus for receiving signals in a digital telecommunication system according to claim 1, ~~2 or 3~~,

characterized in,

- that the phase change information of said two repetition patterns in said reference symbol is used in said synchronising means (5) to detect a cross correlation peak which  
10 indicates the position of the later one of said two repetition patterns.

- Sub B3 5. Receiving apparatus for receiving signals in a digital telecommunication system according claim 4,

characterized in,

- 15 that said cross correlation means (16) has a cross correlation window length corresponding to the length of one repetition pattern, whereby an output signal of said cross correlation means (16) is supplied to a detection means for detecting the cross correlation peak.

- 20 6. Receiving apparatus for receiving signals in a digital telecommunication system according to claim 5,

characterized in,

that said detection means comprises a delay means (20) for delaying the output signal of said cross correlation means (16) by one repetition pattern length and a subtraction

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further comprising an averaging means (23) for smoothening the output signal of said detection means.

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**characterized in,**

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Claim 4  
one of the

**characterized in,**

that the output signal of said cross correlation means (24) or said detection means is supplied to a peak threshold detection means (29) and a gap detection means (30; 34), whereby said cross correlation peak detected by said cross correlation means (24) or  
5 said detection means is confirmed or not on the basis of the detection results of said peak threshold detection means and said gap detection means.

11. Receiving apparatus for receiving signals in a digital telecommunication system according to claim 10,

10 **characterized in,**

that said peak threshold detection means (29) detects if the output signal of the cross correlation means (24) or the detection means exceeds a predetermined cross correlation peak threshold and the gap detection means (30; 34) detects if the output signal of said cross correlation means (24) or the detection means has been below a predetermined  
15 gap threshold before said detected cross correlation peak.

12. Receiving apparatus for receiving signals in a digital telecommunication system according to claim 11,

**characterized in,**

20 that the output signal of said cross correlation means (24) or said detection means is delayed in a delay means before being supplied to said gap detection means.

13. Receiving apparatus for receiving signals in a digital telecommunication system according to claim 11,

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**characterized in,**

that said gap detection means (34) additionally detects if the output signal of said cross correlation means (24) or the detection means has been below said predetermined gap threshold during a predetermined gap time.

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14. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system, comprising the steps of

receiving a reference symbol comprising at least two repetition patterns, whereby one of said at least two repetition patterns is phase shifted in relation to the other repetition pattern, and

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synchronising the receiving apparatus in the digital telecommunication system using said received reference symbol, whereby at least one of said two repetition patterns is cross correlated within a cross correlation window having a predetermined length.

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15. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system according to claim 14,

**characterized in,**

that said at least two repetition patterns are the last two repetition patterns in said reference symbol.

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16. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system according to claim 14 ~~or 15~~,

**characterized in,**

that said phase shifted repetition pattern is phase shifted by  $180^\circ$  in relation to said other repetition pattern.

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a 17. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system according to claim 14, ~~15 or 16~~,

**characterized in,**

5 that the phase change information of said two repetition patterns in said reference symbol is used in said synchronising step to detect a cross correlation peak which indicates the position of the later one of said two repetition patterns.

Sub B31  
10 18. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system according claim 17,

**characterized in,**

that said cross correlation window length corresponds to the length of one repetition pattern, whereby a detecting step after in said cross correlation step is performed for detecting the cross correlation peak.

15 19. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system according to claim 18,

**characterized in,**

20 that in said detecting step a delay step for delaying the output signal of said cross correlation step by one repetition pattern length and a subtraction step for subtracting the output signal of said delay step from the output signal of said cross correlation step are performed.

25 20. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system according to claim 18 ~~or 19~~;

**characterized by**

further comprising an averaging step for smoothening the output signal of said detection step.

- 5 21. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system according to claim 17,

**characterized in,**

that said cross correlation window length corresponds to the length of two repetition patterns for detecting the position of the cross correlation peak.

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22. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system according to claim 21,

**characterized in,**

that a positive and a negative conjugation of an expected repetition pattern is used in

- 15 said cross correlation step for detecting the position of said cross correlation peak.

23. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system according to <sup>claim 17</sup> ~~one of the claims 17 to 22~~,

**characterized in,**

- 20 that after said cross correlation step or said detection step a peak threshold detection step and a gap detection step are performed, whereby said cross correlation peak detected in said cross correlation step or said detection step is confirmed or not on the basis of the detection results of said peak threshold detection step and said gap detection step.

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24. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system according to claim 23,

**characterized in,**

- 5 that in said peak threshold detection step it is detected if the output signal of the cross correlation step or said detection step exceeds a predetermined cross correlation peak threshold and in said gap detection step it is detected if the output signal of said cross correlation step or said detection step has been below a predetermined gap threshold before said detected cross correlation peak.

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25. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system according to claim 24,

**characterized in,**

- 15 that the output signal of said cross correlation step or said detection step is delayed in a delay step before said gap detection step is performed.

26. Synchronising method for synchronising a receiving apparatus in a digital telecommunication system according to claim 24,

**characterized in,**

- 20 that in said gap detection step it is additionally detected if the output signal of said cross correlation step or said detection step has been below said predetermined gap threshold during a predetermined gap time.

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